**Well-to-Wheel environmental assessment of bioethanol-gasoline blends – the effect of detergent additives**

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The environmental impacts resulting from use of biofuels, as alternatives to fossil fuels, are generally well understood via numerous attributional and consequential life cycle assessments (LCAs). Especially climate change and land use impacts have received much attention, whereas other environmental impacts are less understood.

Problems addressed in recent literature include different upstream supply chains (e.g. *corn-grain* or *lingo-cellulosic*) for ethanol manufacturing, which implies different relative contribution to the climate change impact category. Additionally, the contribution from process chemicals, enzymes, and additives, towards the total environmental impact of ethanol production, is highly variable (from 3% to 30%) depending on the ethanol feedstock. Moreover, previous research indicates that significantly more acetaldehyde is emitted in the exhaust from the combustion of ethanol, in comparison with the exhaust from combustion of gasoline.

In order to improve the engine operational parameters of ethanol-gasoline blends, multifunctional detergent additive packages (MDAPs) are being developed. The life-cycle environmental impacts of the additives are not well known. The Polish-Norwegian research project BIOTRETH aims at devising MDAPs for treatment of ethanol-gasoline fuel blends with up to 85% ethanol, so-called E85. Compared to State-of-the-Art, BIOTRETH targets that the new MDAP compounds will improve the combustion efficiency, reduce harmful engine emissions, as well as reducing the overall Well-to-Wheel environmental impacts. The project applies an integrated platform, where research and technological development of additives go hand in hand and provides primary data to the LCA and the health impact assessments.

Multi-variant results are obtained from the assessment of environmental impacts from the production (Well-to-Tank) of selected MDAPs, in combination with various ethanol-gasoline blends. Moreover, the inherent toxicological properties of the MDAPs are determined, which contribute to the understanding of their overall hazards and risks. The emission components resulting from including these new MDAPs in the ethanol-gasoline blends are determined and included in the Well-to-Wheel LCA and health consequence assessments.

The assessment of the environmental impacts from the production of the individual additives as well as the complete MDAPs is estimated using molecular structure-based models. Finally, the optimal MDAPs, from technical, economic, eco-environmental and health point of view, are elucidated.